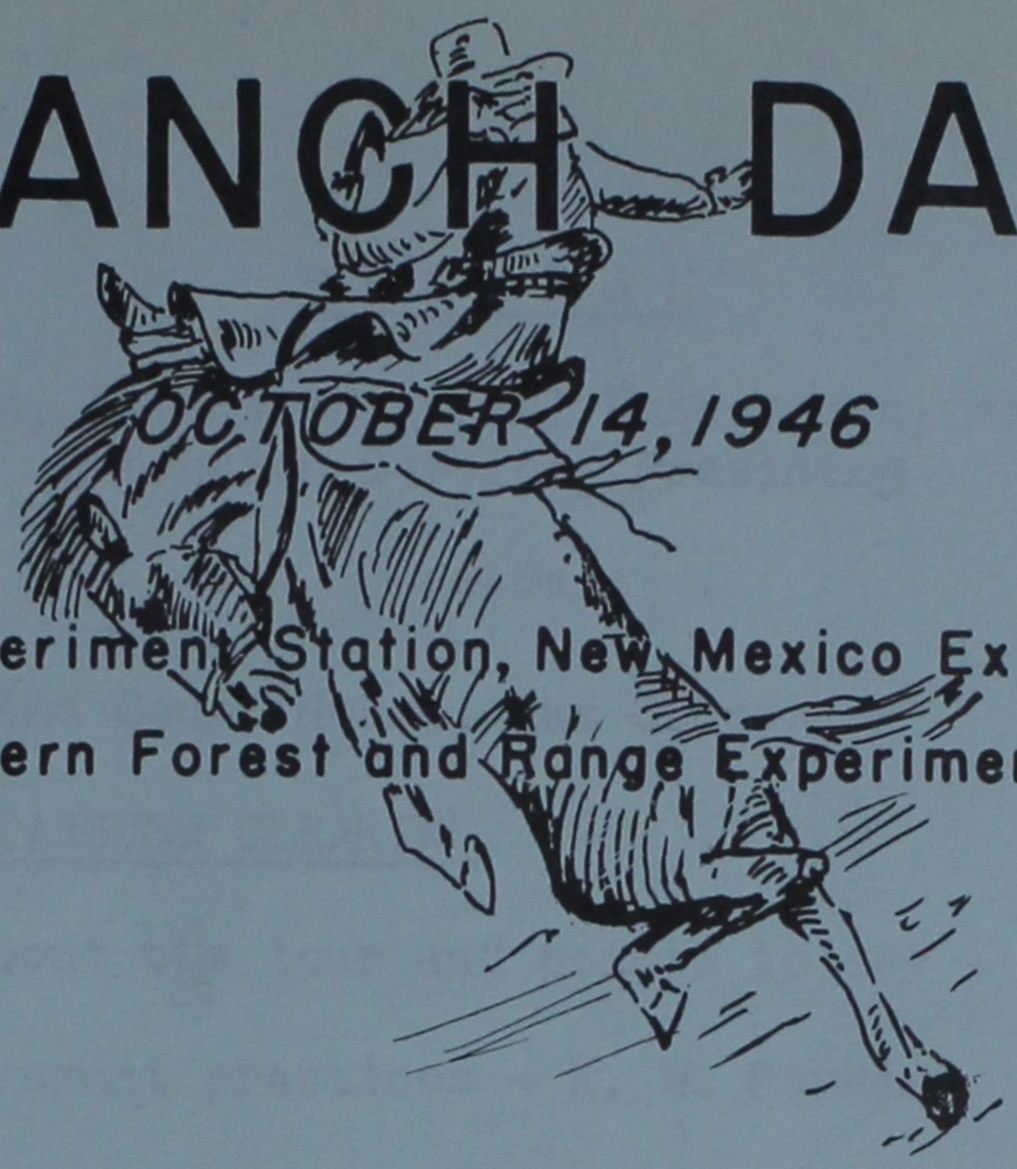
RANCH DAY



OCTOBER 14, 1946

New Mexico Experiment Station, New Mexico Extension Service

Southwestern Forest and Range Experiment Station

HEALTHY, PRODUCTIVE LIVESTOCK PRODUCED FROM AMPLE YEARLONG FORAGE

Experimental Ranch

New Mexico College of A. and M. A.

Jornada Experimental Range

Southwestern Forest and Range Experiment Station

P R O G R A M

Ivan Watson, Extension Animal Husbandman, New Mexico Extension Service, Presiding

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7:30 a.m. Leave Dona Ana Court House, Las Cruces

8:10 a.m. PASTURE 6, TARBUSH CLEARING

Something about the tour and points to see - Ivan Watson

Range improvement practices - K. W. Parker

9:00 a.m. PASTURE 10

Effects of herd composition and different rates of stocking on livestock production - F. N. Ares

Supplemental data from Santa Rita Experimental Range - Matt Culley

Judging range conditions and range use - George E. Glendening

10:10 a.m. PASTURE 2, COOP. RIM

Mesquite control - S. Clark Martin

Demonstration of Aerosol Fog Machine

11:00 a.m. HEADQUARTERS, JORNADA EXPERIMENTAL RANGE

Some promising species for range reseeding in New Mexico - J. O. Bridges

11:30 a.m. See exhibits on display

11:45 a.m. Chuck wagon lunch

12:30 m. Welcome by Hugh M. Milton, President, New Mexico College of Agriculture and Mechanic Arts

12:40 m. Welcome by Raymond Price, Director, Southwestern Forest and Range Experiment Station

12:50 m. Present status of the livestock industry and what might lie ahead - George Godfrey, President, New Mexico Cattle Growers Association

1:10 p.m. Improving the efficiency of range livestock - Floyd W. Lee, President, New Mexico Wool Growers Association

1:30 p.m. HEADQUARTERS CORRALS

Value of a purebred herd in a livestock operation - B. A. Christmas, Cooperator, Jornada Experimental Range

2:15 p.m. MESQUITE SANDHILLS ENCLOSURE

Jack rabbits and rodents and their effects on grazing lands - J. F. Arnold

3:00 p.m. Enter New Mexico A. & M. A. College Ranch

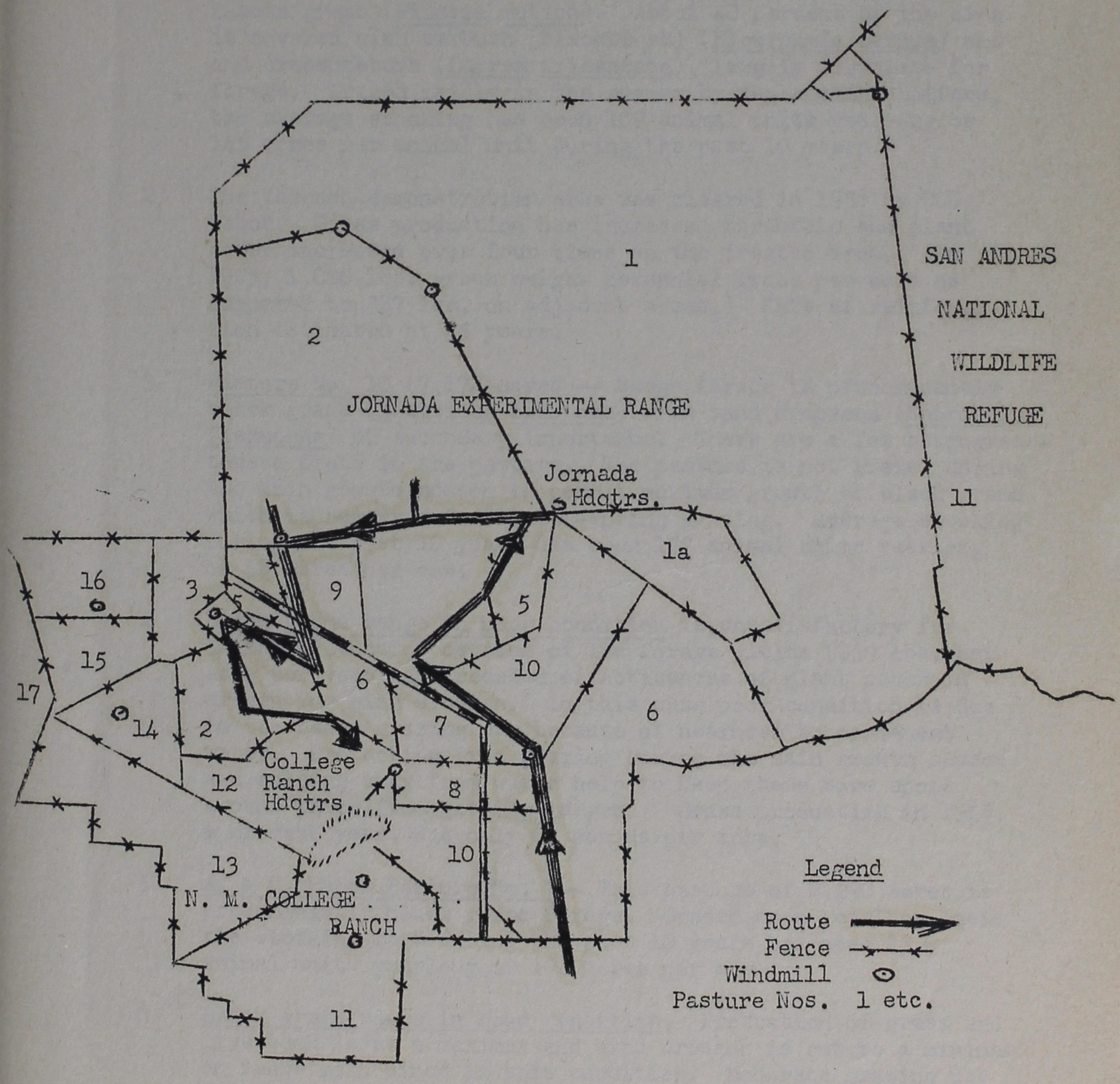
3:15 p.m. CAMP WELL

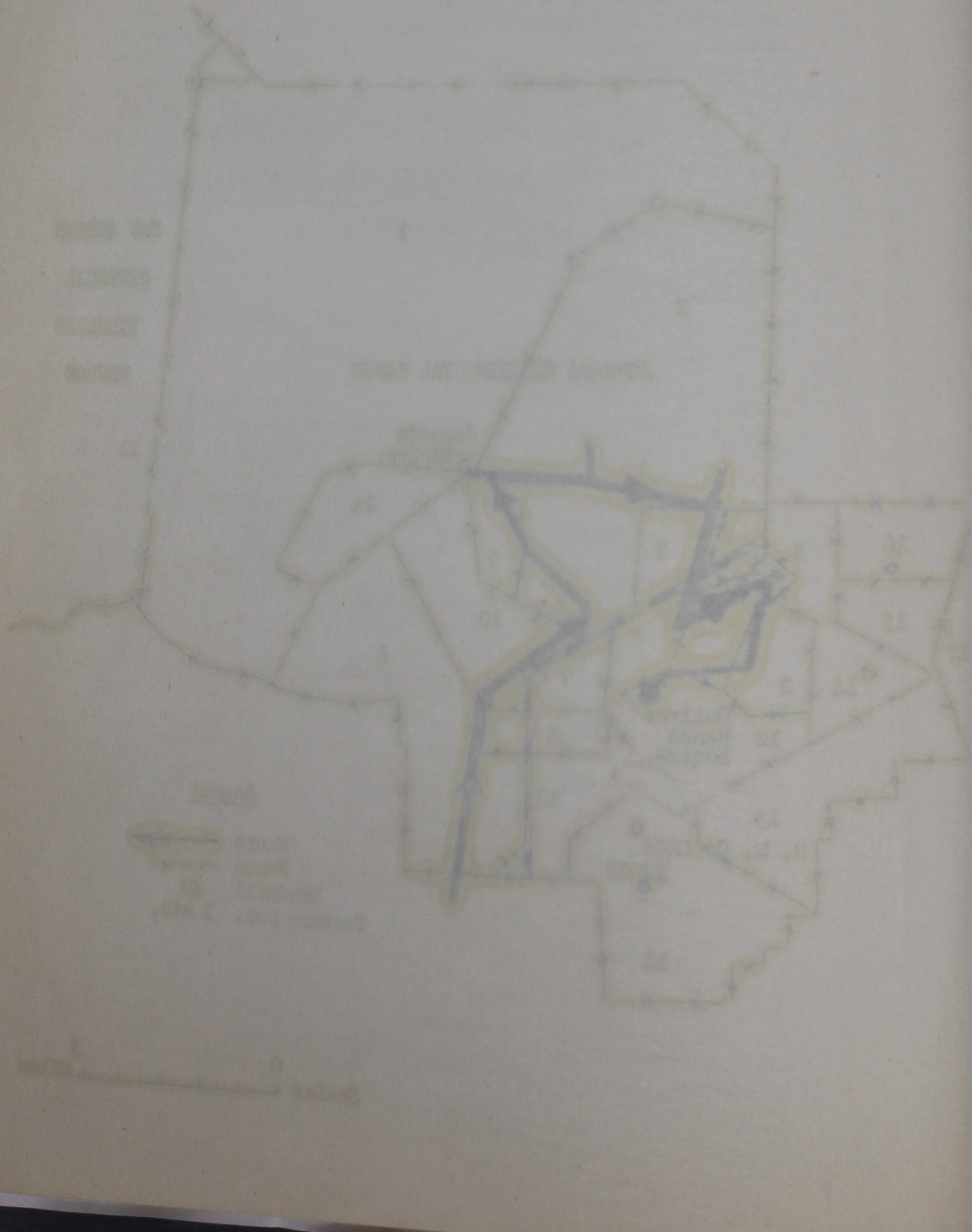
A preliminary report on a study of type in range cattle - Marvin Koger

4:15 p.m. RESEEDING AREA

Recent results from reseeding experiments - K. A. Valentine

ROUTE TO BE FOLLOWED ON SIXTH RANCH DAY TOUR OF
JORNADA EXPERIMENTAL RANGE AND NEW MEXICO A & M A COLLEGE RANCH





POINTS OF INTEREST ALONG THE RANCH DAY TOUR

Sign No.

1 Pasture No. 6— The range forage in this pasture which comprises 15,837 acres is mainly burro (Scleropogon brevifolius)and tobosa grass (Hilaria mutica). About 40 percent of the area is covered with tarbush (blackbrush) (Flourensia cernua) and and creosotebush (Larrea tridentata), largely worthless for forage. Grazed mainly in the summer by replacement heifers, the average stocking has been 109 animal units yearlong or 145 acres per animal unit during the past 10 years.

2 The tarbush demonstration area was cleared in 1936 by CCC labor. Grass production has increased threefold and plant cover increased over four times on the treated area. (In 1945, 1,080 lbs. green weight perennial grass per acre as compared to 327 lbs. on adjacent areas.) Rate of reinfestation estimated at 25 years.

3 Pasture No. 10 (7,172 acres)— Range forage is predominantly black grama (Bouteloua eriopoda) with sand dropseed (Sporobolus flexuosus) of secondary importance. There are a few burrograss-tobosa flats in the pasture. The pasture is not grazed during the main growth season to permit maximum growth of black grama which is reserved for winter-spring grazing. Average stocking during the past 10 years has been 137 animal units yearlong or 52 acres per cow.

4 Black grama range in poor condition is unsatisfactory for animal production because of low forage yields (239 lbs. per acre per year) and reduced effectiveness of plant cover in preventing wind erosion. In this case poor condition is due to too heavy grazing use because of nearness to permanent water. Protection from grazing during the main growth season and salting away from water help to keep these sore spots around water from getting larger. Grass production in 1945, a drought year, was only 63 pounds per acre.

5 A. & M. Ranch Pasture No. 7— This pasture of 2,490 acres is predominantly black grama forage. Grazed on a yearlong basis the stocking rate during the past 10 years has been 23.9 animal units yearlong or 104 acres per cow.

6 Black grama range in good condition. Production of grass and livestock is at a maximum and wind erosion is cut to a minimum on range maintained in this condition. Moderate grazing use and protection during summer growth season are most valuable aids in attaining this condition. Average grass production is 468 lbs. (dry weight) per acre. In 1945, a drought year, it was 498 lbs.

Sign No.

7 Pasture No. 2— This pasture of 32,115 acres is grazed mainly in the winter-spring season. Over two-thirds of the area is covered with the low grazing capacity mesquite (Prosopis glandulosa) sandhills. Range forage in the south end of the pasture is mainly black grama and reserved for winter grazing use. Average rate of stocking during the past 10 years is 218 animal units yearlong or 147 acres per cow.

8 Mesquite seedling control study— This area is devoted to demonstration of possible methods for controlling small seedling mesquite. Four one-tenth acre plots were laid out in June 1946. The average number of seedlings on these plots was 274 or 2,740 per acre. One plot was sprayed with 3 gallons of diesel oil; one was left untreated; and the remaining two were sprayed with different concentrations of 2,4-D. All three treatments show promise, especially the 2,4-D chemical, since it may be conveniently applied with the aerosol fog machine.

9 Grama forage study— This small pasture of 160 acres is grazed exclusively in the winter. Area fenced in 1937 to study: (1) effect of winter grazing use on black grama and animal weights; (2) to correlate actual grazing use with estimates of annual forage crop.

10 Mesquite dune control study— Also in June 1946 several treatments were tried on mature shrubby mesquite in the dune stage. The treatments included several types and concentrations of 2,4-D dissolved in water and sprayed on the stems and leaves, diesel oil spray, injection of diesel oil into the dune, and injection of carbon bisulfide into dunes. As yet none of these methods appear to be effective for killing large dune-forming mesquite. Further study is planned in the near future.

11 Pasture No. 5— This small pasture (1,780 acres) is used for a holding trap and hospital pasture. Range forage black grama grazed yearlong. Average stocking during the past 10 years is 20 animal units yearlong or 89 acres per animal.

12 Pasture No. 2—(See sign No. 7)

13 Pasture No. 1— This extremely large pasture of 80,739 acres has been used on a yearlong basis continuously since the establishment of the Jornada. Range forage is mainly tobosa, black grama, chamiza (Atriplex canescens), and mixed grasses with extensive areas of creosotebush, and mesquite sandhills. The average stocking rate for the past 10 years is 613 animal units yearlong or 132 acres per animal.

Sign No.

14 Mesquite sandhill natural revegetation study. — This area of 640 acres was closed to all livestock grazing in 1931 in order to provide a large area to study: (1) the rate of range improvement by natural means under no livestock grazing; (2) the effect of rodents and jackrabbits on range vegetation. Rate of range improvement as measured by increase of perennial grasses has been negligible. There has been a marked increase in chamiza. The slow rate of recovery is attributable mainly to the presence of jack rabbits.

15 Pasture No. 9 —Area 3,172 acres, predominantly black grama forage. Summer deferred and reserved for winter-spring grazing use. Ten-year average stocking rate 73 animal units or 44 acres per animal.

16 A. & M. College Ranch Pasture No. 6— Area 2,266 acres, mostly black grama range with small areas of mesquite sandhills and tobosa. Grazing use has been yearlong at an average rate of 21 animal units or 108 acres per unit.

17 A. & M. Pasture No. 1— Area 2,432 acres. This black grama pasture is one of a group of three similar sized pastures where studies were initiated to determine the effect on cattle of supplementing the range forage with minerals high in calcium and phosphorus. Findings have been published in numerous New Mexico Experiment Station bulletins. Pasture used on a yearlong basis. Rate of stocking past 10 years 25.6 animal units per year or 95 acres per animal.

18 A. & M. Pasture No. 5.—This small pasture of 640 acres is mainly black grama and is grazed mainly in the late fall for weaning calves. Average stocking past 10 years is 8.2 or 78 acres per animal.

A. & M. Pasture No. 2.—One of the original mineral feeding experimental pastures. Area 2,318 acres predominantly black grama grazed yearlong. Average stocking rate past 10 years 17.6 animal units or 132 acres per animal.

A. & M. Pasture No. 12— Area, 4,745 acres. Except for the fenced reseeding areas, no livestock have been grazed in this pasture since 1935. Range is mostly sandhill mesquite-creosotebush types of low grazing capacity. Improvement in range condition slow due mainly to jack rabbit grazing.

RANGE IMPROVEMENT PRACTICES

By Kenneth W. Parker
In Charge of Range Research
Southwestern Forest and Range Experiment Station

The purpose of this joint ranch day is to point out some of the main features of our experimental work--with the hope that it may be helpful to you people in shaping up a better, more healthy herd of cattle and in bettering the condition and productivity of your range. In fact, nearly every talk you will hear today will be on some phase of range or livestock improvement.

We realize that many stockmen present today do not have range land exactly like that which we have represented on the two experimental ranges. If anything, many of you use land of much higher grazing capacity than this, being more favorably endowed by nature with regard to rainfall. Undoubtedly many of you have blue grama or curley mesquite or even buffalo grass. However, many of the things you will see and hear today pertain to basic management principles and as such can be used with profit on most ranges. As a matter of fact in many of the talks today you will also hear about some of the experimental work we are carrying on elsewhere in the region as well as that being conducted on the Jornada and the College Ranch.

In looking over the experimental ranges today there are several things to keep in mind.

1. The experimental setup or design. There are several ways of doing range research work--one is by the test tube method--one is by small closely controlled experimental pastures--one is by carrying on an intensive study of a practical ranching operation. In the main our work here at the Jornada since 1915 has been set up on a practical ranching basis with the belief that our findings would be more immediately helpful to stockmen. Mr. B. A. Christmas is the ranch cooperator. He furnishes the livestock which are grazed according to a plan of management developed in advance.

2. Our plan of range management here on the Jornada Experimental Range, in simple terms, is to graze each part of the range to best advantage from a seasonal standpoint--that is, graze tobosa (Hilaria mutica) and burrograss (Scleropogon brevifolius) while it is palatable and reserve the black grama (Bouteloua eriopoda) for winter-spring grazing. This pasture here, for example, is composed mostly of tobosa-burrograss which are of most value in summer when green. It is now the end of the main grazing season.

3. In the black grama pastures that you will visit the main growing season is complete and the forage crop that you see on the ground will have to last until next July when the new forage crop is produced.

Ninety percent of our perennial grass growth takes place in July, August, September.

4. The rainfall here on the Jornada plain averages 8 to 9 inches per year with 50 percent of it concentrated in the months of July, August, and September. Last year we suffered a severe drought receiving only about 50 percent of our long-time seasonal average of about 5 inches. This past season was good although total summer rainfall was only about average. Evaporation is over 90 inches a year. Soils are mostly sandy and subject to severe wind erosion.

5. Note the condition of the livestock on the two experimental ranges—I believe that we produce as fine range cattle here as any place in the West. That is because of ample yearlong forage.

In range improvement every ranch presents a separate problem or even a set of problems. There are a number of improvement practices which the rancher may carry on to improve the condition of his range and his livestock operation.

One of the main objectives in making this stop is to point out a few phases concerning control of undesirable range plants as a range practice. Some of you may recall that we were supposed to stop here last fall but the day ran out on us. Last year would have been better because it was a drought year and the contrast more marked. This area was cleared in 1936 by hand grubbing with CCC labor at an estimated cost of $5.00 per acre. A few figures on the area taken in 1945 may be of interest. They show that the area cleared of tarbush (Flourensia cernua) produced three times the amount of grass as the uncleared area (1,080 lbs. green weight per acre as compared to 327 lbs. per acre).and that the grass cover is over four times as dense as that in the adjacent brush. Most of the grass that you see here is burrograss which is relatively poor forage but a lot better than nothing and certainly it is a step forward in getting something better to grow.

Aside from the increased forage crop, there are several other points worth mentioning.

1. The climate will support just so much vegetation. This is particularly evident during drought years which are apt to be frequent and severe. Eliminating the tarbush competition has increased the available moisture so that the grasses have responded with increased cover. Elsewhere in the Southwest we have found that elimination of competition from undesirable shrubs and trees is desirable in nearly all instances—snakeweed (Gutierrezia sarothrae), burroweed (Aplopappus tenuisectus), mesquite (Prosopis spp.), and we hope to determine the facts in the case of juniper (Juniperus spp.). Some of these noxious shrubs and trees during the past half century have invaded millions of acres of formerly open grassland. These invasions are nearly always accompanied by a decrease in grazing capacity. Some of these

worthless plants, such as snakeweed, are relatively short-lived and can be controlled by moderate grazing practices which will permit the grasses to offer full competition. On the other hand, many of these plants are long-lived. For example, we estimate that the tarbush here will live for nearly 100 years and no degree of moderation in grazing will eliminate them once they have become firmly established. Some of these undesirable range plants have not only invaded grassland but in their natural sites have increased greatly in abundance at the expense of the grass. For example, the tarbush here—our photographic records in this pasture show an increase in abundance of the shrubs in the past 30 years and an accompanying decrease in forage production.

2. To eliminate these noxious plants will require drastic means—if the range livestock industry hopes to continue in the future the use of many range lands for the profitable production of livestock. In many instances hand methods can meet the problem of control—but on extensive range areas these undesirable plants are so numerous and well established that cheap machine or chemical methods will have to be developed.

3. The rate of reinfestation—this area was cleared in 1936—the tarbush will probably reinvade the area in the next 15 years or so, which means that the treatment is good for about 25 years (of course if a larger area had been treated, the rate of reinfestation probably would have been slower). We have found that this is likewise true in the case of other noxious shrubs such as mesquite; the treated areas will in many instances be invaded again in about 25 years—moderate grazing will retard this invasion—but the point is a regular yearly financial outlay for range improvement on many ranches will have to be made if they are to be kept in a productive condition.

Probably one of the greatest problems confronting the stockman curiously enough offers at the same time one of the best opportunities for range improvement—and this is in the proper adjustment of livestock numbers to the forage supply. It is important to the rancher that he graze the correct numbers, both from the standpoint of his pocketbook and the ultimate permanence of his business. Rainfall and forage growth vary greatly from year to year. It is true that drought is a major factor which must be considered and there is nothing we can do about the weather. We can, however, cushion the effects of drought by planning for it through proper management. Fluctuations in range forage and their relation to proper numbers of livestock have been under study now for about 30 years here at the Jornada Experimental Range. This study shows that if stocking is made on the basis of the average year's forage crop—the cattle will be on short rations over half the time. We know because in the early years of our operation we tried doing that. On the other hand, stocking on the basis of 65 percent of average forage production safeguards the rancher in most years and in a bad drought year necessary

reductions can be made by rigid culling without undue sacrifice of the breeding herd. We also know that this is true because that practice is, and has been, the basis of our operation here since 1935.

There are three main channels into which each year's forage crop must go. Part will go into the production of livestock—part will be returned as litter to enrich the soil, and part will be left on the plants as plant food for renewed growth. The latter two channels are especially important from the long-time productivity of the range but under moderate grazing use they do not conflict with efficient livestock production. In general about 50 percent of the herbage of the palatable plants should be left at the end of the grazing year. In the case of black grama this means leaving a stubble height of 3 to 4 inches. During drought reserve forage cushions the operator against severely damaging his range and at the same time gives him added protection against having to sell short on a poor market or spend excessive amounts for short feed supplies. Thus, leaving some ungrazed grass on the ground is just "like money in the bank."

An example of how dependent beef production is on the quantity of forage available to each animal is given in the results of a study made at our Santa Rita Experimental Range in southern Arizona. In a study of two 6-year periods begun in 1934 and just completed, beef production per cow was increased over 60 pounds (from 298 to 361), the average yearly calf crop was raised to 90 percent (from 84), and the weight of the mother cows increased from about 850 to over 1,000 pounds. Although part of these increases in production were due to more rigid culling and better bulls, the biggest factor was found to be adequate yearlong forage. Needless to say, if stocking had been heavier in the first 6-year period the differences would have been still greater. Mr. Ares will present some figures for the Jornada at the next stop. Following the weight trend and productivity of a breeding herd is a good practice, and one of the best investments that a rancher can make is a set of livestock scales—provided he will use them regularly.

Although adjustment in range use may appear to be a difficult problem to solve, sometimes it can be helped by such improvement practices as additional fencing or water development which will aid in better distribution. But there are economic limits to which the rancher may go in this direction. Ordinarily we figure that a new water development should have enough forage around it of sufficient value to warrant the cost of the installation. On the other hand, if the water development and fencing will result in general improvement of the range elsewhere, or if it will permit segregation of the various classes of animals, or if it will allow the practice of some deferred or rotation system of grazing—then the cost of these additional improvements can be spread over the entire operation.

As an example of the value of fencing in herd management, we have found in a 20-year study just completed at the Santa Rita Experimental Range that the smaller pastures yield the highest calf crops. Small

pastures of 3 or 4,000 acres produced about 5 percent greater calf crops than a larger pasture of 10,000 acres in size.

Range reseeding is another worthwhile range improvement practice which offers great possibilities for providing additional forage and building up ranch values. Reseeding can't take the place of good management and conservative stocking. However, it is especially recommended on many areas where management alone is too slow or uncertain to bring about improvement. The costs of reseeding are akin to buying new land and here in the Southwest we have learned that certain rules must be closely followed to secure success and protect the investment in the practice. Proper reseeding methods call for treatment of the soil to remove competition, covering the seed at the proper depth, seeding to correct species for the site, planting at the most favorable time of year, protecting the rseeded area until the plants are firmly established, and moderate grazing when a stand has been secured.

Years ago here in the West when cheap range land was available, the practice was to move to a new and better range in order to maintain herd numbers. Of recent years there has been no new range land to move to and it has been largely a matter of better use of existing lands. In the east it has long been realized that certain cultural practices are necessary to maintain the productivity of permanent pastures. This is true on the very finest of soils and under very favorable climatic conditions. I believe it is safe to say that continuous use of many range lands for grazing purposes will be found to be economically impractical unless some regularly established system of improvement is made a part of the management of these areas. The time is now past when one could step out and buy range lands cheaply or purchase land from a nearby neighbor and the only alternative for a rancher is to make the best of his present range and increase its grazing capacity.

In concluding this talk I have pointed out a few possible range improvement practices---some of these are going to need further research before they are practical everywhere in the Southwest—but I believe the future productivity and permanence of our range livestock industry is going to depend on how well we manage the basic resource--the range---and in many instances how much time and effort is spent on proven range and livestock improvement practices.

EFFECTS OF HERD COMPOSITION AND DIFFERENT RATES OF STOCKING ON LIVESTOCK PRODUCTION

By F. N. Ares
Superintendent, Jornada Experimental Range

One of the main objectives of the work on the Jornada Experimental Range during the past 30 years has been to develop methods of range management which would conserve and improve the range, ease the disastrous effects of drought, and produce a maximum amount of beef at less cost. During the 30-year period 1916 to 1945 pertinent data on the livestock production phase of the study have been collected on: (1) number and classes of cattle grazed; (2) calf crops; (3) death losses; (4) sales and purchase data, including weights of cattle sold and purchased, prices received and paid; (5) costs of production of livestock including overhead and every other expense incidental to a ranching enterprise. Collection of these records has been made possible through the constant help of cooperating stockmen who have furnished the cattle grazing the Jornada.

The Jornada has been managed as a breeding cow operation ever since its creation in 1915. The cooperators have depended chiefly for their revenue and profit upon calves raised and sold as yearlings or baby beef. However, during the 30 years of grazing some variation in management has occurred and it is of interest to study the make-up of the herds in order to determine what make-up and size constitutes the most profitable operation. In other words, what is the effect of herd composition and different rates of stocking on livestock production?

The period of study covers 29 years. Based mainly on rate of stocking and management practices in effect, the 29 years are divided into three periods as follows: Period 1, from 1916 to 1924; Period 2, from 1926 to 1937; Period 3, from 1938 to 1945. Livestock production and other results of herd and range management will be discussed under the appropriate headings.

Period 1 - 1916 to 1924

Period 1 is characterized chiefly by heavy stocking. In fact total stocking by all classes of livestock for this 9-year period is over twice the grazing capacity as considered proper today. This rate of stocking resulted in damage and a decline in grazing capacity of the range. At that time there existed little or no data for setting up correct stocking standards for semidesert ranges. Ranges everywhere in the Southwest during and after the war emergency of 1918 were stocked beyond their capacities and the Jornada was no exception. Furthermore, ideas of grazing capacity at that time were generally high according to present findings.

Table 1.— Total stocking, breeding cow ratio, loss and calf crop data for first period from 1916 to 1924, inclusive.

Calendar year	Total adult stocking*	Total breeding cows	Breeding cow ratio	Losses adult livestock	Calf crops percent
	No.	No.	Pct.	No.	Pct.
1916	3,785	2,022	53.4	52	72.2
1917	3,810	1,986	52.1	59	64.1
1918	2,714	1,809	66.7	59	58.8
1919	2,516	2,156	85.7	88	43.7
1920	2,985	1,615	54.1	45	83.2
1921	2,984	1,146	38.4	53	67.3
1922	1,902	1,008	53.0	69	64.3
1923	1,473	727	49.4	30	67.5
1924	2,351	1,678	71.4	40	72.7
Average 9 yrs.	2,724	1,572	57.7	2.0%	65.1

* Animal unit consists of all livestock over the weaning age (8 mos.)

Considering the rate of stocking, calf crops and low death losses for this first period were fairly good. This is due to several reasons: (1) The ratio of adult stock (breeding cows) is low— calves were shipped at weaning time in poor years and held over as yearlings in good years. Breeding cows made up only 58 percent of the herd. (2) Two unusually favorable rainfall years occurred at the beginning of the period. (3) Heavy supplemental feeding of chopped soapweed (Yucca elata) and protein concentrates undoubtedly greatly reduced death loss and maintained cows in a more productive condition than would have been otherwise possible on range forage alone. Analysis of cost data for the period indicated that it cost $11.27 annually to support a cow and $17.65 to raise a calf to weaning age.

Period 2 - 1926 to 1937

This 12-year period, or a good part of it, might be termed the recovery period from the heavier stocking of Period 1 as well as the after effects of the 1924 drought. Rate of stocking was reduced by over 50 percent but the breeding cow ratio was increased to 70 percent of the herd. As a result, calf crops were increased nearly 10 percent and the expensive feeding of chopped soapweed and concentrates was eliminated altogether. Other influencing factors for Period 2 are: (1) unfortunately two changes of cooperators were made and each time a new experimental herd was brought on the range these herds contained some very poor quality breeding stock; (2) in building up the herds the cooperator was compelled to buy cattle from drought stricken areas with resultant higher death

losses and poor calf crops; (3) the 1934 drought, the most severe in all Jornada history, resulting in considerable financial loss to the cooperator because of forced removals and sacrifice sales on a poor market.

Table 2.— Total stocking, breeding cow ratio, loss and calf crop data for second period from 1926 to 1937, inclusive.

Year	Total adult stocking	Total breeding cows	Breeding cow ratio	Losses adult livestock	Calf crop percent
	No.	No.	Pct.	No.	Pct.
1926	545	620		17	73.5
1927	912	705	77.3	15	76.0
1928	971	604	62.2	8	80.6
1929	1,891	665	35.2	42	76.1
1930	1,192	847	71.1	14	70.8
1931	1,088	831	76.4	17	71.2
1932	1,347	1,063	78.9	36	83.0
1933	1,633	1,443	88.4	50	76.2
1934	1,455	1,438	98.8	69	62.9
1935	1,116	505	45.3	12	61.2
1936	1,240	729	58.8	5	72.7
1937	1,491	966	64.8	11	90.3
12-yr. average	1,240	868	70.0	2.0%	74.6

✱ The year 1925 has been omitted because the range was not stocked due to change of cooperator.

The average annual cost of maintaining a cow for the period was $8.65 and $12.06 for raising a calf. This represents a considerable reduction over Period 1 and to some extent reflects the relatively low cost of labor and materials which characterized this period.

Period 3 - 1938 to 1945

Adult stocking for Period 3 was a little less than the average for Period 2 but the ratio of breeding cows was much lower--56 percent as compared to 70 percent of the total stocking as in Period 2. This plan of management yielded the highest average annual calf crop— 84 percent— and the lowest rate of death loss. Average yearly costs of production increased to $10.13 per cow and $13.70 per calf due mainly to supplemental feeding of calves in winter and a general rise in commodity prices which went into production costs.

Table 3.— Total stocking, breeding cow ratio, death loss and calf crop data for third period from 1938 to 1945--8 years.

Year	Total adult stocking	Total breeding cows	Breeding cow ratio	Losses adult livestock	Calf crop percent
	No.	No.	Pct.	No.	Pct.
1938	948	609	64.2	4	91.5
1939	1,111	542	48.8	20	61.6
1940	1,299	725	55.8	20	85.4
1941	1,314	756	57.5	16	71.4
1942	1,131	633	56.0	15	90.1
1943	1,065	612	57.5	17	94.1
1944	1,098	554	50.5	5	84.3
1945	1,176	662	56.3	14	88.8
8-year average	1,143	637	55.7	1.0%	83.5

Feeling that fairly satisfactory progress had been made on the problems of increased calf crops, reduced losses and reduced costs of production by finding the correct capacity and regulating the rate of stocking to this to provide sufficient range forage at all times, the principal emphasis in Period 3 was placed on management to provide drought insurance. By this is meant the handling of the herd in such a way as would eliminate froced removals or sacrifice sales of breeding stock in drought years as had happened in such years as 1934. To accomplish this the ratio of breeding herd was reduced from 70 percent in Period 2 to 56 percent in Period 3. During severe drought it has been the plan to remove all other classes of cattle such as feeder calves, replacement heifers, yearlings, over-age, and dry cows and other classes which can be sold, moved, or disposed of with little loss and much more conveniently than can mother cows. In favorable years when surplus forage is available the idea is to take up the "slack" by bringing in outside calves or yearlings for pasture in the winter.

For purposes of drought insurance the plan has worked well. Two very unfavorable years and one severe drought year (1945) were encountered in Period 3 but no forced sales or removals of breeding stock were necessary. Moreover, there has been financial benefit from the plan of bringing in outside cattle in the good years to use up the surplus feed. One important caution, however, is to make sure there really is a surplus of forage,otherwise overstocking will prevail as is brought out in Period 1.

Beef Production

Sales data of livestock, especially by weight, are not complete for the early years of the experiment making up most of Period 1. However, for the succeeding 20 years of both Periods 2 and 3, sales data from all classes of livestock are available. The use of these data gives an opportunity to compare production in terms of pounds of beef for these latter two periods with comparable rates of total adult stocking but with varied ratios of breeding cows in the herd. (Table 4.) A noticeable feature of Period 2 is the marked annual variation in numbers of cattle sold. This is reflected in the receipts per breeding cow which ranged from a low of $1.35 in 1931 to a high of $80.66 in 1937.

Table 4.— Total beef marketed from Jornada 1926 to 1937 inclusive, and receipts calculated on basis of average selling price for the 20-year period. Average breeding cows, 868—70 percent of total stocking, 1,240.

Year	Total beef marketed from Jornada	Receipts at 20-year average selling rate of $6.9957 per cwt.	✱ Receipts per breeding cow at 20-year average rate of $6.9957 per cwt.
	(Lbs.)	(Dollars)	(Dollars)
1926	68,750	4,810.24	5.54
1927	347,204	24,289.35	27.98
1928	198,817	13,908.64	16.02
1929	539,414	37,735.79	43.47
1930	674,519	47,187.33	54.36
1931	16,716	1,169.40	1.35
1932	423,016	29,592.93	34.09
1933	781,442	54,667.34	62.98
1934	112,351	12,057.16	13.89
1935	242,888	16,991.72	19.58
1936	256,276	17,928.30	20.65
1937	1,000,834	70,015.34	80.66
Total	4,722,237	330,353.54	380.57
Average	393,520	27,529.46	31.71

✱ Fluctuations in receipts per breeding cow are due to variation in numbers of livestock sold each year.

This table, in terms of pounds of beef, presents the yield from all classes of cattle sold from the Jornada from 1926 to 1937. This includes only the gains of livestock brought in from the outside and later sold. It will be recalled that in Period 2 total stocking was 1,240 head; the breeding cow ratio 70 percent or 868 cows. The loss record was 2.0 percent; the calf crop, 74.6 percent. In table 4 is presented the actual pounds of beef marketed and the value as

calculated from the rate prevailing throughout the full 20 years. It is noteworthy in this period that livestock were marketed regularly each year in contrast to the erratic method in Period 2. This permitted a sounder basis of operation with less risk from drought and the vagaries of a fluctuating market.

Table 5.— Total beef marketed from Jornada for 8-year period from 1938 to 1945 inclusive, and receipts calculated on basis of average selling rate for 20-year period. Average breeding herd, 637— 55.7 percent of total stocking, 1,143.

Year	Total beef marketed from Jornada	Receipts at 20-year average selling rate of $6.9957 per cwt.	Receipts per breeding cow at 20-year average rate of $6.9957 per cwt.
	(Lbs.)	(Dollars)	(Dollars)
1938	544,210	38,071.30	59.77
1939	367,635	25,718.64	40.37
1940	383,344	26,817.60	42.10
1941	469,326	32,832.64	51.54
1942	406,122	28,411.08	44.60
1943	301,026	25,593.56	33.06
1944	365,847	27,199.28	40.18
1945	388,800	27,199.28	42.70
Total	3,226,310	225,702.97	———
Average	403,289	28,212.89	44.29

Table 5 shows the net beef yield from cattle produced and sold on the Jornada during Period 3, or from 1938 to 1945, inclusive. As shown by table 3, total stocking for Period 3 was 1,143, only a hundred head less than for Period 2. However, the breeding cow ratio was reduced to 637 head of cows or 55.7 percent of total stocking. Death losses averaged 1.0 percent, calf crops 83.5 percent.

Net average annual production of beef for Period 3 is shown to be 403,289 pounds as compared to 393,520 pounds for period 2. This represents a gain of 9,769 pounds average per year in favor of Period 3 with its lighter total stocking, smaller breeding cow ratio, and the more flexible method of herd management. It may also be noted that annual sales of beef during this period fluctuated very little from year to year. Since about 21 percent of the sales of Period 3 were the yearlings brought in from the outside to take up the slack in years of surplus forage, only the weight gains of these yearlings while grazed on the Jornada are considered in the net annual beef production for this period.

Summary

In reviewing the three periods of stocking on the Jornada Experimental Range since 1916 it is evident that: (1) First and most important of all, the range must be stocked so that the numbers of livestock will always be in balance yearlong with the range forage. This is the simple definition of good range management. No amount of grade improvement and good herd management practices can offset this. (2) The size of the herd should be regulated so that the breeding cows are given highest priority in allotting the available range forage supplies. This means that numbers of breeding stock should be kept well within the grazing capacity of the range during any year except the occasional phenomenal drought such as 1934. This insures the mother cows an ample supply of forage in all years. The surplus forage in good years can always be utilized by holding the natural increase or by purchasing steers or other stockers from outside range. (3) Such a plan of herd management will provide a large amount of drought insurance by preventing forced removals or sacrifice sales, also providing satisfactory financial returns. The increase in calf crops of Period 3 over Period 1, for example, was 18 more calves per hundred cows; also fewer death losses and reduced costs of production were obtained. These resulted from the better management practices such as reduced stocking, better distribution and control of livestock obtained throughout the latter periods. The actual value of the gain in beef production of Period 3 over that of Period 2 with a comparable rate of stocking was only $683.41 per year. However, that a better grade of livestock was produced in Period 3 is obvious from the increased weights per animal unit. (4) The stocking policy followed in Period 3 resulted in a greater degree of protection from the effects of ever recurring drought, and finally, a policy of regular annual marketing as has been followed in recent years as contrasted to the erratic methods of former years has been an important factor in placing the operation on a sounder financial basis as well as providing additional insurance against drought risk.

JUDGING RANGE CONDITION AND RANGE USE

By George E. Glendening, Forest Ecologist
Southwestern Forest and Range Experiment Station

"Range Condition" can be called the state of health of the range or the productivity of the range in terms of what it could and should be.

"Good Range Condition" implies: (1) a desirable mixture of nutritious and palatable plants capable of making good vigorous growth under the climatic conditions which are characteristic of the site; (2) a stabilized soil, increasing in fertility and having a protective mantle sufficient to cause the water from all but the most intensive rains to be readily absorbed by the soil.

A range unit which meets those qualifications would be accepted as "par" by any ranch operator because under those conditions the rancher can expect maximum forage and livestock production, minimum worry about recurrent drought, and, most important, "over the long haul," maximum protection to his soil.

To the extent that a crop of forage is produced and harvested each year by livestock, a range unit is like a farm, and just as is the case with farm practices, the effects of grazing upon the vegetation and the soil will be reflected in future forage crops. In other words, the range writes its own story in the form of certain "telltale" signs, which, when we have learned to interpret them, will tell whether the effects of past range management have been good or bad. We call these signs "indicators."

On the chart which follows, three major kinds of indicators are listed, namely: Plant, Soil, and Animal. Taken together these three factors record the visible effects of all the factors of the environment, including grazing. In order to simplify this discussion, only two broad condition classes have been listed, Good and Poor. Ordinarily two other classes, Excellent and Fair, are employed. In using any aid or guide to judging range condition such as this chart, it must be realized that, at the best, it can serve only as a reminder or check list of factors that ought to be considered by the examiner. The relative value to be attached to each of these factors will vary from place to place and must be decided by the examiner on the ground and on the basis of conditions which he finds at each specific site.

I. Plant Indicators

Density

Density, or the percent of ground covered by vegetation is normally limited by climate. In other words, the maximum amount of perennial vegetation which a given area can support is limited by the moisture which the area receives. In the Southwest it varies from about 25 percent on our 9" to 12" rainfall semidesert ranges to more than 50 percent on the higher areas where annual precipitation exceeds 20". Consequently, in

RANGE CONDITION

(The state of health of your range & how to figure it.)

	Good	Poor
I. PLANT INDICATORS:		
A. Percent of Ground Covered (DENSITY)?		
1. Dense stand of forage plants.....	x	
2. Thin or patchy stand of plants.....		x
B. What Kind of Plants (COMPOSITION)?		
1. Good forage plants predominate.....	x	
2. Poor or worthless plants predominate.....		x
C. How Much Growth Do They Make (VIGOR)?		
1. Best plants make good growth every year.....	x	
2. Best plants make poor growth most years.....		x
II. SOIL INDICATORS:		
A. Does Bare Soil Have Protective Cover (LITTER)?		
1. Plant debris covers most of soil.....	x	
2. Bare soil obvious and predominant.....		x
B. Does Soil Drift When the Wind Blows?		
1. Slight or none except during highest winds....	x	
2. Lots of dirt in the air; dunes forming.....		x
C. Active Sheet Erosion?		
1. Plants sit level with the ground.....	x	
2. Many plants are up on pedestals.....		x
D. Active Gully Erosion?		
1. No gullies present or old gullies healing.....	x	
2. New gullies forming or no evidence of healing.		x
III. ANIMAL INDICATORS:		
A. Condition of Cows?		
1. Weight 950 lbs.....	x	
2. Weight 750 lbs. or less.....		x
B. Condition of Calves?		
1. Average weight 400 lbs. at 8 mos.....	x	
2. Average weight 275 lbs. at 8 mos.....		x
C. Percent Calf Crop?		
1. Over 90 percent.....	x	
2. Less than 60 percent.....		x
D. Population of Forage-Eating Rodents?		
1. Not very plentiful—no problem.....	x	
2. Excessive—markedly affects feed supply.....		x
	____	____
Total of all Indicators.....		

order to be used as an indicator of range condition the plant cover on the area being examined must be mentally compared with the maximum density which the site is capable of supporting as evidenced by the vegetation on moderately used or protected areas.

Under moderate grazing the desirable species of grass are allowed to mature seed and reproduction which is vital to the maintenance of a grass stand is favored. Studies show that the ground cover may increase under moderate grazing judiciously applied.

Where heavy grazing is practiced, it is usually noted that the amount of vegetation, particularly that of perennial grasses, is not as great as it might otherwise be. Repeated close grazing causes the root system of grasses to become smaller so that less water can be used by the plant and thus causes lowered forage production. Reproduction by vegetative processes is hampered by heavy grazing and seedlings of the desirable forage plants are seldom found where close grazing year after year is the common practice.

As a general rule, a continuing thin stand indicates some disturbance and is usually a sign of poor range condition. Also as the better forage plants are eliminated or thinned out other less desirable plants take their place. This brings up the next item on this check list of things to consider when sizing up a range. This item is composition.

Composition

This is probably the most valuable of all the guides because: (1) a change in the kind of plants on an area shows up quickly, (2) the relative numbers of the various kinds of plants is not much affected by annual fluctuations in climate. Consequently, the effect of management is more clearly indicated by this factor than by changes in total amount of plant cover or density. For example, if a farmer finds a lot of weeds in his grain field, he immediately wonders if something is wrong with his farming methods. By the same token, when a stand of forage grasses begins to be occupied by such plants as pingue, snakeweed, burroweed, or cactus, it is a sign that the management being employed is not best suited to the continued production of a forage crop.

Major changes in kind of vegetation on an area such as a replacement of grasses by a shrubby plant like snakeweed are not apt to go unnoticed, even in a casual inspection. However, if sufficient care is used in inspecting the range, it is possible to detect changes in the vegetation which are much more subtle and of more critical importance to the ranch operator. I refer to changes in the kinds of grasses present which occur as a result of differences in relative palatability and resistance to grazing of the various kinds of grasses. For example, a highly significant but not too apparent change in composition has taken place in the woodland type of northern Arizona and New Mexico where blue grama now covers vast areas to the exclusion of almost all other forage plants. On these areas

several highly desirable species of grasses have been eliminated, but the blue grama sod persists. In spite of the relatively good stand, studies indicate that the blue grama over much of this area commonly produces only about 50 to 200 pounds of usable feed per acre. This is perhaps one-tenth the forage produced on these same areas when such grasses as Junegrass, needlegrass, feathergrass, sideoats grama, galleta, and other good forage grasses were growing along with the blue grama. This low production represents an extreme loss of vigor by the blue grama.

Vigor

By vigor is meant the relative productivity of the individual plants, or the ability of a plant to make the most of its environment. Over the Southwest as a whole, low vigor is one of our greatest range problems. In range grasses, good vigor is recognized by some or all of the following signs: numerous, tall seedstalks; large unbroken clumps with abundant basal leafage; dark green color; large, well-filled seedheads, and quick early growth when climatic conditions are favorable. Actual measurements here on the Jornada have shown that black grama when in poor vigor produces 180 pounds of forage per acre as compared with 370 pounds of forage per acre produced on similar sites and under identical rainfall where the black grama is in good vigor.

II. Soil Indicators

Litter

Litter, or the unused herbage from past forage crops which accumulates as debris on the soil surface, is of critical importance here in the Southwest. Litter serves as an insulating layer between the soil and a dry atmosphere. It shades the soil from the sun, protects it from the puddling action of beating raindrops, it lengthens the period surface soils stay moist, and affords a favorable place for seeds of perennial grasses to germinate. Hence the presence of litter on the ground surface is one of the signs of good range condition.

Drifting Soil

Where light sandy soils and high winds are encountered, soil drift may be a serious factor. At first it is seen as small deposits of loose soil around the base of bushes, fence posts, and other obstructions. Drifting soil simply means that there is not enough vegetation on the ground to hold the soil in place and, consequently, is a sign of poor range condition. If uncontrolled on sandy soil types, it eventually means the formation of moving dunes. Again, of all classes of vegetation, grass, because of its fibrous roots and large volume of herbage produced close to the ground, does the best job of tying down a loose soil.

Sheet Erosion

This form of erosion occurs typically on bare or sparsely covered areas of moderate slopes where water runs off rapidly because it is not readily absorbed by the soil. It is characterized by pedestaled plants and the more or less general loss of friable topsoil and exposure of subsoil. These underlying subsoils are less pervious to moisture, less fertile, and require more water to produce a given amount of plant growth. When water runs off his range, the rancher loses in two ways: less moisture gets into the soil so that forage production is reduced and, the running water carries topsoil with it. Consequently, evidence of sheet erosion must be considered as a sign of poor range condition.

Because of the high intensity which characterizes the local summer storms typical of this region, some surface runoff must be expected on any range. However, if after one of these high intensity storms an area shows no visible evidence of rill marks, miniature fans, or lodging of debris against surface obstacles, it is a positive indication of good range condition.

Gully Erosion

On some types of soil a loss of plant cover results in the rapid formation of a gully system. Gullies are usually but not always associated with relatively steep slopes. Some of the most extensive and most serious gully systems in this region may be seen on nearly level ground within the sagebrush type of northern New Mexico. From the standpoint of the vegetation, gullying always causes an area to become drier, because most of the water is channeled off the area at the time it falls. Given time and under moderate use, gullies will become vegetated. This, of course, is a good sign. So far as accelerated erosion or any abnormal loss of soil is concerned, whether from blowing or washing, it must be considered as an undesirable sign. We can't afford to lose any soil in the Southwest and, from the long-range view, any degree of grazing use that does not allow the development of a sufficient stand of plants to hold the soil in place is unwise.

III. Animal Indicators

The Condition of the Livestock

The level of production on a range as indicated by the weight of cows, weight of calves, and percent of calf crop can be a reliable indicator of range condition on ranges that are used year long for breeding purposes, provided that the average production over a considerable period of years is used. It is not a reliable indicator where the livestock spend only a part of the year on the area in question or if the production figures for only an occasional year are considered. Careful study of the New Mexico College of Agriculture & Mechanic Arts has shown that the figures given on this chart, namely 950-pound cows, 400-pound calves, 90-

percent calf crop, are attainable, and for the past 10 years the production on the Santa Rita Experimental Range in southern Arizona has been at that level.

Population of Rodents

There is a good deal of evidence that high populations of forage eating rodents are associated with poor range condition. That is, most range rodents seem to prefer a weedy area or one with a sparse vegetative cover, to a well-grassed site. However, rodent populations seem to exhibit a cyclic characteristic, or at least a tendency toward sporadic peaks and lows in numbers, and so are difficult to correlate with vegetation. Nevertheless, I believe you will agree that rodents are not usually a cause for worry on ranges that are in good condition and producing a high volume of forage; whereas on seriously depleted areas, rodents may offer a serious problem to range improvement.

Summary

1. In sizing up a range, the amount and kinds of plants present, as well as the amount of vigor displayed by these plants should be carefully noted.

2. Soil is the basic resource on range lands just as on cultivated lands because without fertile soils there can be no sizable forage crop. The development and maintenance of a productive soil requires a continuing supply of humus which can come only from the decayed debris of plants which grow on the area.

3. Here in the Southwest where moisture is the critical limiting factor, it may well be that the quickest method for increasing the forage production on most ranges is to get them covered with a layer of litter. To do this means leaving some ungrazed grass.

MESQUITE CONTROL

By S. Clark Martin, Forest Ecologist
Southwestern Forest and Range Experiment Station

Mesquite control work at the Southwestern Station has been largely concentrated on finding control methods for the tree form of mesquite (Prosopis velutina) since it is the most common grassland invader in southeastern Arizona and much of West Texas. The shrubby form of mesquite (Prosopis glandulosa), which on sandy soils forms dunes such as you see here on the Jornada, calls for different control techniques. This past summer some preliminary trials were made of several different chemical spray solutions on the shrubby form of mesquite varying from the seedling stage to the mature dune-forming plants. These tests will be discussed briefly before presenting the methods used for mesquite trees.

Experiments on Sandhill Mesquite

The first experiment was designed to compare the effectiveness of three spray solutions for killing seedling mesquite in dense stands. One plot was sprayed with 10,000 ppm. 2,4-D, a solution 10 times as strong as that used for lawn weeds. Another was sprayed with 5,000 ppm. of 2,4-D. The third plot was sprayed with diesel oil. Although expensive, these methods do show promise. These same chemicals, together with several other methods, were also applied last June on large dune mesquite but so far results have not been too encouraging. You will see some of this work after you leave this stop.

We know that if the small seedling mesquite plants are allowed to mature range deterioration and eradication costs will both be greatly increased. Furthermore, no practical method for eliminating the mature dune-forming mesquite has yet been developed. For occasional seedlings, a grubbing hoe is still the most practical but for dense stands we need to find more effective control methods.

How to Kill the Tree Form of Mesquite

Seedlings.—The best, easiest, and surest way to kill the tree form of mesquite also is to grub the little ones with a sharp mattock. They can also be killed by certain kinds of sprays and it is likely that in many areas power machinery for spraying dense reproduction will need to be developed. However, grubbing requires no expensive, hard-to-carry chemicals, and no complicated equipment to get out of order. For large mesquite, other methods are usually more economical.

For the tree form of mesquite having a single trunk or possibly two or three large stems arising from the ground, several eradication methods have been used. None of these has been entirely satisfactory and not all have given consistent results. In general the methods are hand grubbing, grubbing with power machinery, killing trees or stumps with poisons such

as sodium arsenite, and killing trees with kerosene, diesel oil, or similar petroleum products.

Grubbing.—Labor costs usually prohibit the use of hand grubbing in dense mesquite stands or even in light stands when trees are large. It is primarily a method of preventing further spread by keeping down the seedlings. By this method light or moderate stands can be cleared of young plants at costs varying from a few cents to as much as $3 per acre. Heavy stands would be much more expensive to handle. Power machinery has been used to eliminate mesquite in Texas. Costs range from $2 per acre upward. This is for the bulldozer type of equipment with which trees are uprooted. Because the trees are lifted out by the roots comparatively little sprouting results from this method. A few of the disadvantages of the method are: (1) high cost of equipment; (2) tearing up of grass sod in dense mesquite; and (3) the cost of removing the brush and stumps.

Portable or tractor driven power saws and the mammoth tree shears are also tools which are being used for mesquite control. The difficulty with these tools is that all the stumps left by such machines must be treated to prevent sprouting. Thus one has the expense of double treatment. In some cases income from the sale of wood and posts will offset all or part of the cost of eradication.

Chemical methods of killing mesquite trees include those in which poisons or oils are used as the killing agent. Sodium arsenite is thus far the surest and cheapest poison we have for killing mature trees or stumps. It is extremely poisonous to both animal and man and must always be used with the utmost care. However, if proper precautions are taken there is slight danger of livestock loss or harm to workman. In general, workers should change clothes frequently and pastures should not be grazed immediately after poisoning unless a good rain has fallen to wash away any spilled or excess sodium arsenite.

Attemps to kill mesquite with oils have given highly variable results. On the Santa Rita Experimental Range we have obtained kills ranging from 0 to 100 percent. Other workers have also experienced similar difficulty.

Where Do the Sprouts Come From?

Mesquite sprouts come from a bud zone just above the top of the taproot. This zone usually extends to depths of 6 inches or more in older trees and may be buried to a depth of 2 feet or more in bottom lands where rapid sedimentation has occurred. These buds are numerous and are all capable of sprouting, therefore they must all be killed to prevent sprouting of the stump.

How Does Sodium Arsenite Work?

Sodium arsenite travels in the sap stream of mesquite and kills all tissues it reaches. Also it travels up and down the stem quite rapidly but moves around the stem slowly. Therefore, if a tree is girdled on only one side and poison applied there, only that side is apt to be killed. If a stump is being treated it is apt to sprout unless thoroughly poisoned all the way around. Two other factors affecting the use of sodium arsenite are the promptness of application and concentration of the solution. For best results the poison should be applied immediately after the wood is cut. And the solution should contain at least 3 pounds and preferably 4 pounds of arsenic trioxide per gallon.

How Do Kerosene and Similar Oils Work?

Oils do not travel in the sap of the plant and therefore are contact poisons. In order to prevent sprouting the oil must reach every live bud on the stump. The only way to be sure this is accomplished is to use plenty of oil. The amount of oil required will depend on (1) the depth of the bud zone; (2) the size and complexity of the stump; and (3) the structure, texture, and moisture content of the soil. Dry soils absorb oil much more rapidly than moist soils and wet soils are practically impervious to oil. Consequently, if oil is used, it should be used in quantity and put on when the soil is dry. Fisher, at the Spur Station, Texas, found that kerosene, diesel oil, and crankcase oil were about equally effective. Diesel oil has given best results in our work. The light oils, such as kerosene and diesel oil, have the advantage of penetrating the soil more rapidly. In general about a quart of oil per tree will give good results but a deep bud zone requires more oil than a shallow one. A large, knotty, much-branched stump takes more oil than a small, smooth, single-stemmed one. A tight clay soil takes more than a loose sandy soil, and if the soil is wet it is best to wait until it dries. The season of the year seems to have little effect on percent kill except in that some seasons are wetter than others.

2,4-D

The newest chemical on our list is 2,4-D. Thus far we have had little encouragement in these studies on mature mesquite. However, we know that the concentrations of 2,4-D ordinarily used on lawn weeds are too weak for mesquite. We know that dry weather is more favorable for spraying with 2,4-D than is wet weather. We know that small plants are more easily killed than larger trees. Perhaps we lack only the right combination but at present we're not recommending 2,4-D for mesquite control.

Methods of Applying Poisons

Oils or solutions of sodium arsenite may be effectively applied to mesquite in several ways. The method one chooses should be governed by the type of mesquite with which he has to deal. Large, single trunked trees can be easily girdled at the base with an axe and a small quantity of sodium arsenite applied to the frill. Shrubby plants with

several small stems should have a dilute solution of sodium arsenite poured into a basin dug around the base of the plant. Both of these types may be killed by spraying sodium arsenite or diesel oil around the plant base, by pouring it into a basin, or, under favorable conditions, by simply pouring it around the tree from a can.

Cost of Mesquite Control

Power eradication.—Power equipment now used for mesquite control is expensive. Consequently, this method of clearing is probably out of the question for all but the largest ranches. Costs a few years back ran as low as $2 per acre, depending on the number and size of trees per acre.

Sodium arsenite.—In 1940, with sodium arsenite at 70 cents per gallon and labor at 25 cents per hour, a stand of 80 trees per acre was killed for $1.89 per acre. In 1944, with sodium arsenite at $1.00 per gallon, if you could get it, and labor at 50 cents per hour, the cost would have been about $4.00 per acre. Now, with labor at 75 cents per hour and sodium arsenite at $2 per gallon, the cost would be more nearly $6.50 per acre.

Diesel oil.—On the Santa Rita, with diesel oil at 10 cents per gallon and labor at 75 cents per hour, an acre of mesquite (80 trees per acre) can be killed for about $4. This figure is for application of diesel oil with an orchard sprayer at the rate of 1 gallon per five trees.

Benefits of Mesquite Control

In 1940 an experiment was set up on the Santa Rita to determine the effects of killing mesquite. They are:

More grass: Since 1940 the yearly grass production has been roughly two and one-half times as much on the cleared areas as where the mesquite was left (270 lbs. as compared to 103 lbs. per acre).

More beef: In terms of beef it is estimated the cleared areas would produce beef at the rate of 4,000 pounds per section. On the other hand, the mesquite-infested areas would produce only 1,600 pounds per section. Both estimates allow for conservative grazing use.

Less erosion: A third effect of the return of grass is less water movement and naturally less erosion. The surface soil where mesquite has been removed is protected by perennial grasses and by the litter they produce. There is little erosion and the surface soil retains its moisture longer than where mesquite still grows. Thus, more grass means more moisture in the ground and, in turn, more moisture means still more grass. In this way, recovery tends to gain momentum as conditions improve. Finally, the point will be reached, provided grazing use is moderate, at which the maximum amount of growth will be obtained from the limited rainfall.

SOME PROMISING SPECIES FOR RESEEDING IN NEW MEXICO

By J. O. Bridges, Forest Ecologist
Southwestern Forest and Range Experiment Station

This stop was made to demonstrate what may be expected on a reseeded area the first season. Two of the most promising species for this part of the state were used. Lehmann lovegrass (Eragrostis lehmanniana) was planted on the four acres to the south and Boer lovegrass (E. chloromelas) on the one acre to the north. The seeding was done about the tenth of June this year. The soil was prepared with a single disk and the seed was then broadcast and covered with a cultipacker. The rains on this section of the range were late, coming in the latter part of August and September. Consequently, the stand is not as well developed as would be the case if the rains had come earlier. However, we feel that the stand is sufficiently developed to withstand a reasonably dry spring next year.

This seeding and the row test plantings which you may have seen at headquarters are representative of the type of work the station is doing at several locations in the state. At each of these locations one or two other more extensive tests have also been established. These other tests include methods of preparation and planting experiments and one-fourth acre species yield tests. In these latter tests it is expected to get information on the ability of the better species to establish themselves under range conditions and to measure their yield of usable forage as compared with that from adjacent native range.

I have already mentioned the two most promising species for this section of the state, Lehmann lovegrass and Boer lovegrass. Both of these species were introduced from South Africa about 12 years ago by the Nursery Division of the Soil Conservation Service. Lehmann lovegrass, in tests at the college ranch, has been found to yield from 50 to 100 percent more usable forage per acre than the average stand of black grama. The palatability is not as good as the native grass but the cattle eat it and gain well on it; so the palatability is considered to be satisfactory. Boer lovegrass yields about the same as black grama and has a palatability equally as good.

These two species are adapted only in the southern part of the state as it has been found that they will not survive the winters where the temperature drops much below freezing. Both species do best on light sandy soils, but will do fairly well on moderately heavy soils.

Lehmann lovegrass seed is available commercially this fall at a price of $2 per pound. Boer lovegrass seed as yet is not available commercially.

Perhaps the most widely known and most widely used species for reseeding in New Mexico is crested wheatgrass (Agropyron cristatum). This is also an introduced species, having been imported from Russia in 1898

by the U. S. Department of Agriculture. By 1917 it was regarded as a promising new forage plant at the experiment stations on the northern Great Plains, but it was not until after 1930 that it became generally distributed. Crested wheatgrass has not been tested specifically for yield in comparison with the native species in New Mexico. However, observations indicate a yield of from 100 to 200 percent more usable forage from crested wheatgrass than that produced by the native blue grama (Bouteloua gracilis) at the higher elevations. A further important factor in favor of crested wheatgrass is that it ordinarily greens up at least six weeks ahead of blue grama. The palatability of crested wheatgrass is high for cattle and considered good for sheep.

Crested wheatgrass appears to be able to grow any place in New Mexico where the elevation is above 6,000 feet. It seems best adapted, however, to the northern half of the state where the rainfall is from 14 to 20 inches. It will do nothing at all in the hot southern section of the state even when irrigated. Where it is adapted to the climate, it seems to do equally well on light or heavy soils. Seed of this species is generally available at 16 to 20 cents per pound from a large number of seed houses. Although not too much is known concerning the variation within species of range grasses, some differences in vigor have been noted and attributed to the source of the seed. In ordering seed it is always advisable to deal with a good, reliable, well-established seed firm.

In the eastern plains section of the state, three different grasses seem to be well adapted for reseeding. Of these two are natives and one is an introduced species. The natives are sideoats grama (Bouteloua curtipendula) and blue grama, and the introduced species is weeping lovegrass (Eragrostis curvula). The natives are two of our best range forage plants and doubtless are well known to all of you. The introduced species, weeping lovegrass, was imported from Africa at the same time as Lehmann and Boer lovegrasses. It is not as drought resistant as these two, but will stand considerably lower winter temperatures. Its yielding qualities are very good, probably double that of blue grama. Its relative palatability is only fair; however, when livestock are grazed in a pasture containing only weeping lovegrass, they eat it very well. In New Mexico it seems to be best adapted to areas below 6,000 feet where the rainfall is 15 inches or above. It is probably best adapted to light soils but does fairly well on heavy soils. Seed of this species is obtainable from commercial sources at about $2 per pound. Seed of blue grama and sideoats grama is handled by a number of seedsmen and sells for from 25 to 35 cents per pound.

Costs of seed per acre depend on the rate of seeding as well as on the price per pound; thus sideoats grama at 35 cents per pound costs $3.50 per acre as the seeding rate is 10 pounds, while weeping lovegrass which will produce satisfactory stands with one pound per acre, will cost only $2 per acre. Crested wheatgrass at 20 cents per pound will cost $1.60 per acre where the rate is 8 pounds, while blue grama which requires 6 pounds per acre and costs 30 cents per pound will cost $1.80 per acre.

Costs of seed per acre to raise

So far only grasses have been mentioned. There is one shrub which deserves to rank with the grasses. It is the fourwing saltbush, commonly called chamiza (Atriplex canescens). This species is one of our best native browse plants. It occurs naturally in all parts of the state up to an altitude of 7,500 feet. In the southern part of the state where good stands of chamiza can be grown it yields considerably more per acre than the best grasses. Its palatability, especially during the winter and spring months, is very high. Its one requirement is that it be grown on a calcareous soil, and inasmuch as most of our New Mexico soils are calcareous, this is not a very limiting requirement. Tests have shown than on well prepared seed beds, it is not difficult to get a satisfactory stand of this shrub when planted at the rate of 10 pounds per acre. Chamiza seed is not always available on the market, but it can nearly always be gathered locally at a cost of from 10 to 15 cents per pound or less.

A number of other species have been more or less generally planted over the northern half of the state. These include bluestem or western wheatgrass (Agropyron smithi) as it is sometimes called, and slender wheatgrass (A. trachycaulum). These are both close relatives of crested wheatgrass but are native American species. Bluestem is somewhat more drought resistant than crested wheatgrass and slender wheatgrass somewhat less so.

Smooth bromegrass (Bromus inermis) is a high yielder and a very palatable grass but requires more rainfall than the wheatgrasses and also more than can be expected over most of New Mexico. It is adapted only to the high mountain areas where the rainfall is 18 inches or above.

Sand dropseed (Sporobolus cryptandrus) is a widely distributed native species that has given fair to good results over a wide range of conditions. Results with it have been from fair to excellent in all parts of the state. Its palatability and volume of forage production are not the best, but it is a species often worth being included in mixtures. The seed is usually cheaper per acre than any other species.

Two other grasses that have at times been rather highly recommended for reseeding are Michel's grass (Secale sp.) and bulbous bluegrass (Poa bulbosa). Neither of these has been found to be adapted to New Mexico conditions.

Our experimental plantings are hardly far enough along to turn up any new promising species. However, on the basis of one year's results, there are two species that seem worthy of mention. One of these is intermediate wheatgrass (Agropyron intermedium), a relative of the wheatgrasses mentioned previously. It seems to be somewhat more drought resistant than crested wheatgrass and produced a greater volume of forage in the small row test plots, both in the pinon-juniper and the pine type. The other species is mountain rye (Secale montanum). This grass is supposed to be the ancestor of our common cereal rye. It differs from common rye in that it has much more basal leafage, a smaller grain, and is perennial rather than annual. In the row tests it seemed to be very drought

resistant and produced more forage than any other species tested in the high pine type.

If any of you are planning on doing some reseeding, your first job will be to select the species most adaptable for your use. This is what I have been trying to help you do. After you have selected the species you are going to use, be sure you get it in the ground properly.

In the southern part of the state on loose sandy range soils and on abandoned fields in other parts of the state, single or double disking will be sufficient seedbed preparation. In the eastern part of the state where early spring planting is planned, a preparatory crop of sorghum grain or Sudan grass should be grown the previous year and the grass then drilled into the stubble. This will eliminate danger from blowing.

Where grass is to be planted on uncultivated rangeland, the existing vegetation must be destroyed to prevent competition for moisture with the young grass seedlings. The best way known at present to do this is to plow. It need not be deep plowing. A one-way wheatland-type disk plow set to go 2-3 inches deep will be sufficient and is probably the cheapest. Where steep slopes are worked plowing should be done on the contour. In the sagebrush areas, the wheatland plow has been found to be the most efficient way to rid the land of brush and prepare a satisfactory seedbed at the same time.

There are many ways to get the seed into the soil after the seedbed has been prepared but the most satisfactory, and in the end the most economical way, is to drill it in. This is true no matter in what part of the state you are located. However, if you do not have a drill, satisfactory stands of grass can be obtained by broadcasting the seed and covering it with a spike tooth harrow.

As to the time of year to plant, June, July, and August are the best months in all parts of the state except the Eastern Plains section. There April is best. Although some successful seedings have been made in all parts of the state at nearly all seasons, plantings made in July will give the best results during the majority of the years.

And last but not least, the reseeded area must have protection from livestock the first 2 years after it is planted. It may be grazed lightly at the end of the second year if growing conditions have been good. It should be grazed only moderately the third and fourth years. We have yet to find the species that can withstand very heavy grazing under the semi-arid conditions that prevail in New Mexico.

JACK RABBITS AND THEIR EFFECTS ON GRAZING LANDS

By J. F. Arnold, Forest Ecologist
Southwestern Forest and Range Experiment Station

It has long been suspected that the presence of jack rabbits may affect the management of many southwestern range lands. In terms of grazing capacity it is recognized that jack rabbit grazing destroys valuable forage which would otherwise be available for livestock production. It has been difficult in the past to estimate either the amount of forage consumed or the actual amount of damage that rabbits may do to a range. In recent years the accumulated information of many studies dealing with jack rabbits has made it possible to judge more clearly the actual degree that rabbits can influence range vegetation. We have a good opportunity here to review some experimental facts and figures and apply them to the range conditions of this locality.

This area, in the mesquite sandhill type, offers a good visual demonstration of the way jack rabbit grazing may influence range conditions. Many of you may recall a similar demonstration which was given at the College Ranch last year. That demonstration differed from this in that it is located in the creosotebush type where the soil is more firm and less subject to wind blowing.

The effect of jack rabbit grazing can probably be observed more strikingly on a low productive piece of land such as this than on ranges with better soils and a heavier cover of vegetation. Three different levels of grazing use are represented by the three plots of this area. One plot (represented by pasture 2) is open to grazing by cattle and rodents (including rabbits); one plot in this 640-acre enclosure is open to rodents and jack rabbits but has been closed to cattle since 1931; and the third plot (1 acre in area) has been closed to cattle since 1931 and closed to jack rabbits since 1935. Although the galvanized iron sheeting is supposed to exclude smaller rodents such as kangaroo rats, they have, in spite of this, periodically inhabited the third exclosure. It should be remembered that the plot open to cattle is over 3 miles from permanent stock water. Comparing the conditions of these three areas, we can see the destructive influences jack rabbits may cause. The estimates of density and composition of the plant cover of these three plots were recorded in 1932 and 1941. The comparisons are shown in table 1.

Table 1.— Comparison of density and composition of vegetation on open, cattle exclusion, and cattle and jack rabbit exclusion plots 1932 and 1941.

	Open to cattle and all rodents		Open to all rodents only		Closed to cattle and jack rabbits	
	1932	1941	1932	1941	1932	1941
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Density	27	12	27	18	18	25
Composition:						
Weeds	3	22	3	22	7	1
Grasses						
Black grama	20	12	20	17	5	32
Dropseed	24	8	24	10	5	48
Threeawn	3	1	39	6	3	6
Others	1	4	1	4	2	2
	48	25	48	38	15	88
Shrubs						
Snakeweed	37	36	37	23	58	5
Mesquite	8	12	8	8	18	4
Soapweed	4	5	4	4	2	1
Others	-	-	-	-	-	1
	49	53	49	35	78	11

Owing to the limited personnel during the war years more recent data have not been collected on these plots. But the figures of the table illustrate well the influence of jack rabbits during the drought years of the thirties. It is apparent that the two plots open to cattle and jack rabbits and open to rodents alone declined equally in forage density between 1932 and 1941. The combination of drought and intensified grazing probably accounted for this decline in density. In contrast, the plot closed to both jack rabbits and cattle showed an increase in forage density in spite of the drought years. There was little change in the composition of the plant cover of the open plot and the plot open only to jack rabbits and rodents, but the plot closed to both cattle and rabbits showed a striking increase in grasses and a marked reduction of both snakeweed and shrub species. The increased density and favorable change in plant cover of the plot protected against both cattle and rabbits occurred in spite of the drought years.

From this demonstration we can therefore assume that a jack rabbit population alone can produce sufficient grazing pressure to keep range land such as this in a deteriorated condition indefinitely. The jack rabbit population evidently prevents natural revegetation and the men who have been carrying on the artificial reseeding studies will tell you that rabbits have frequently prevented many reseeding trials from becoming successful.

Now to answer the question: How many jack rabbits do we have on the semidesert range? It is possible from the rabbit counts made by the Fish and Wildlife Service in 1941 and 1942 to estimate the potential forage consumption of the jack rabbit populations here on the Jornada Experimental Range. According to Mr. Trowbridge's report, the jack rabbit populations were estimated for the vegetation types shown in the first half of the following table:

Table 2.— Population estimates of the number of jack rabbits per section found on six range types of the Jornada Experimental Range and their respective cow equivalents.

Range type	Number of rabbits per section		Cow equivalents	
	Count of August 1941	Count of April 1942	1941	1942
Black grama grassland	11	33	.18	.53
Snakeweed-grass	83	-	1.33	-
Tobosa flats	96	260	1.55	4.20
Mesquite sandhills	118	-	1.90	-
Weed types	272	-	4.40	-
Creosotebush type	-	200	-	3.20

From the first part of the table it will be seen that the summer counts of 1941 indicated a population of 11 rabbits per section in the black grama grassland; a population of 83 rabbits per section in the snakeweed-grass type; a population of 96 rabbits per section on the tobosa flats, 118 rabbits per section in the mesquite sandhills, and 272 rabbits per section in the weed types. These population counts demonstrate that rabbits tend to favor the weedy and brushy range types over the better grassland types. The spring counts of 1942 indicate that the rabbit populations of the lower black grama grasslands and tobosa flats increased over the 1941 summer counts. The black grama grassland showed a population increase of from 11 to 33 animals per section, while the tobosa flats showed an increase of from 96 to 260 rabbits per section. It is thought that the rabbits migrate to these lower elevation types during winter and spring. Note that the creosote type showed a spring population of 200 rabbits per section.

In connection with these counts it should be remembered that rodent populations vary from year to year and are cyclic due mainly to feed supply, predators, and prevalence of disease. Thus, since the Jornada counts were made our jack rabbit population has markedly dropped but this last year it appears to be on the increase again.

In estimating how much forage these jack rabbits would consume it is fitting to relate some of the experimental findings published by the University of Arizona. The University workers fed a number of captive jack rabbits and found that of 32 native grasses, 47 weeds, and 21 native browse species fed, the rabbits preferred the native forages in the order of weeds, grasses, and browse. Jack rabbits were reported to eat about equal quantities of weeds and grasses. The high preferences for weeds explains in part the reason for finding the highest rabbit populations on weedy range types.

On the basis of the base-ration feeding trials, the Arizona workers concluded that a jack rabbit will consume the equivalent of 0.29 of a pound or roughly a third of a pound of legume hay daily. According to Morrison's "Feeds and Feeding," a 1,000-pound range cow will require about 18 pounds of legume hay daily. This means that about 62 jack rabbits will eat a daily amount equal to that eaten by a 1,000-pound range cow. In addition to the amounts eaten, it was found that rabbits will often clip off plant stems and leave the stems uneaten, but this wastage was rarely found to exceed 5 percent of the available forage. However, it is possible that under natural conditions the rabbits may destroy a considerable amount of forage during the dry spring of the year by digging out the bases of grass clumps.

Now if we take these figures and apply them to the population of table 2, we can make a pretty good estimate as to how much forage is being consumed by jack rabbits in terms of cow units. The jack rabbit populations of the black grama grassland would remove 0.18 and 0.53 as much as a 1,000-pound range cow. The 83 rabbits per section of the snakeweed-grass type would eat 1.33 as much as a range cow. The rabbit populations of the tobosa flats would remove 1.55 as much forage in summer and 4.2 as much as a 1,000-pound range cow in spring. The jack rabbit population of the mesquite sandhills, this type we are now in, would remove 1.9 as much as a range cow. The populations of the weed types and the creosote bush type would eat 4.4 and 3.2 respectively as much as a range cow. In other words, if all rabbits were removed from all the range types listed, with the exception of the black grama grassland, it would be potentially possible to run from one to four additional head of livestock per section.

According to the table then the population of 118 rabbits per section in this mesquite sandhill type could potentially remove as much forage as two range cows. It is generally estimated that this mesquite sandhill type will normally carry about two head of mature cattle per section. Is it a wonder then that this plot which is open to jack rabbit grazing alone shows no better range condition than the area open to the grazing of both cattle and jack rabbits?

Without doubt there is need for jack rabbit control measures on ranges of this type. As yet no safe, cheap, and convenient control methods have been developed. Rabbit drives, shooting, and poisoning still continue to be the main control methods. None of these are completely satisfactory. Much work remains to be done to develop successful control methods. The Fish and Wildlife Service started to search for a successful control method in 1941 but this work was interrupted by the war. It is hoped that they will be able to resume their activity on this work.

1. To summarize briefly the important points of this demonstration, by comparing these three plots we may conclude that jack rabbit grazing alone may keep a range such as this in a continual state of low productiveness, may prevent natural recovery, and often bring failure to reseeding tests.

2. The rabbit counts made by the Fish and Wildlife Service on the Jornada indicated that the largest rabbit populations favor the weedy and brush range types over the better grassed areas in summer and that the rabbits tend to migrate to lower elevations in winter and spring.

3. The published experimental results of the University of Arizona indicate that jack rabbits have a somewhat higher preference for weeds than do cattle which bears out the evidence of higher populations being found in the more weedy range types. According to these results 62 jack rabbits consume as much as a 1,000-pound range cow.

4. Applying the University's results to the population estimates of the Fish and Wildlife Service, we concluded that with the exception of the black grama grassland type the jack rabbit populations here on the Jornada were capable of eating as much as 1 to 4 range cows per section. The jack rabbit population of this mesquite sandhill type equalled the forage removal of about two cows per section which is about the same as the estimated grazing capacity of this range type. This bears out the observed evidence where the rabbit grazed plot shows no better range condition than the plot grazed by cattle and rabbits together.

5. It is quite evident from this demonstration that practical rabbit control methods need to be developed and applied as a range management practice on many of our southwestern ranges which are infested by abnormally large jack rabbit populations.

A PRELIMINARY REPORT ON A STUDY OF TYPE IN RANGE CATTLE

Marvin Koger

Frequently the question is asked, "Is size or type of most importance in beef cattle?" Some people feel that the influence of the showring has over emphasized compactness at the expense of other desirable qualities. Others have felt that emphasis on size leads to the development of rangy, slow-maturing cattle.

These factors are ones that can be used readily in picking replacement stock and, used singly or in combination, are likely the most widely used criteria in selection of breeding animals.

In the spring of 1945, an experiment was begun to study the effect of selecting one herd of cows on the basis of compactness and another herd on the basis of weight. The original selections for the two groups were made from cows produced on the college ranch. For the former, which will be known as the "compact" group, 31 of the most compact cows were selected. Thirty-nine of the heaviest cows on the ranch were selected for the "large" group. The compact cows were bred to compact bulls, large cows to large bulls. This breeding plan will be continued and replacements will be picked from the calves produced by the respective groups. It is planned to maintain about 40 breeding cows in each herd. The groups will be bred separately but at other times will be run under similar conditions. This plan will demonstrate breeding programs based on two methods of selection and will make possible a comparison of production and performance under otherwise similar treatment and conditions. In addition, the remainder of the college herd can be used as a check.

The performance of the original cows, previous to going on the experiment, is shown in the accompanying table. It can be noted that the large cows had weaned calves that were on the average 7 days older than the compact cows. This difference is significant and shows a greater number of late calves from the compact cows. The calves from the large cows were consequently slightly heavier at weaning, but the weights of calves were similar when adjusted to a standard age.

The calves from the compact cows graded slightly higher than calves from the large cows, the compact calves averaging above the herd average while the large calves averaged just below.

This year's calf crop is the first resulting from breeding large cows to large bulls and compact cows to compact bulls. At the time of this writing, the stock has not been weighed so space is left in which to record information which will be provided during the discussion on the program.

	Compact	Large
Previous production history		
Number of cows in original selection	31	39
Average weaning age of calves, days	201	208
Average weaning weight of calves, pounds	406	414
Weight at 205 days of age, pounds	412	412
Average grade of calves*	103.0	99.6
Performance on experiment		
1945		
Number of cows on experiment	31	39
Number of cows dry	4	2
Average weight of cows, pounds	897	1080
1946		
Number of cows in group	33	42
Number of dry cows		
Average weight of cows, pounds		
Average weight of calves, pounds		
Grade of calves		

*The calves were graded from C- to A+ and numerical scores assigned to each grade. B is equivalent to 90, B+ to 100, A- to 110, etc. The grades shown above are expressed as a percent of the average grade of the entire calf crop.

RECENT RESULTS FROM RESEEDING EXPERIMENTS

K. A. Valentine

The experiment station has been conducting experimental work in range reseeding here on the ranch for a period of 11 years. Well over a hundred different species and strains of native and exotic grasses have been included in the tests, as well as a number of shrubs and weeds. Very few of this number have shown any promise, and only two of the grasses have been found suitable for extensive seeding trials. These are Lehmann lovegrass and Boer lovegrass, both of which were introduced from Africa. Most of the larger stands of grass at this site are either one or the other of these grasses or mixed plantings of the two.

Even with these two grasses, which appear to be so well suited to our conditions, we have not been successful in getting a stand of seedlings every time we have planted. We have found that our seed plantings have resulted in an established stand of seedlings only about 50 percent of the time. Study of the rainfall records representing this site indicate that only about half or a little less than half of the years had sufficient rainfall to establish a stand of these grasses. We do not regard this as a great defect in either of these grasses, however, for we must remember that even our very best adapted native species are not successful every year in reproducing themselves either by seedling establishment or vegetative means.

Our work here has indicated that some preparation of the soil is needed. Also we have observed that it is necessary to actually get the seed into the soil, not merely to broadcast it on the surface. The seed of these grasses is very small and should be covered only lightly, even in sandy soil. Covering seems to be a compromise between getting the seed deep enough to stay moist until it germinates and keeping it shallow enough so that it will come through to the surface. Most of our seeding has been done in the surface inch of soil, and we believe that planting should not be deeper than this.

All our seeding here has been done in the month of July. We think this is the best time to seed under our conditions, for then if the seed is brought up by good summer rains it has a fairly good chance of growing through till frost, thus becoming well enough established to survive the winter and spring dry period. Planting early in spring would not be favorable here we feel because seedlings emerging, say, in April or early May would fail to survive the hot dry weather of late May and June which we experience here in most years. Our work here has indicated pretty clearly that rains must come in July, August, or early September in order to have the seedlings become well enough established to survive the winter. Two of our good stands of seedlings have been lost because they were brought up by rains so late, one in late September and one in early October, that they were not well established when frost stopped their growth.

This year we made an extensive seeding of a mixture of Boer and Lehmann lovegrasses on about 40 acres just southeast of here, near headquarters. Although we have not had a particularly good season, we did have one fairly good rain which brought the seedlings up and enough additional rains to keep them growing fairly well since. We now have a good stand of pretty well established seedlings on the area.

What has been said of the effect of late rains on seedling emergence and establishment does not hold for growth of well-established plants. We have observed that these two lovegrasses make a considerable amount of growth early in the spring and late in the fall. Last year practically all the growth of these grasses was made after October 10, and they remained green well into November. This characteristic of greening up early in spring is especially valuable here on our semi-desert ranges, for it is at this time of year that green forage is so scarce. The fall growth is possibly almost as important, as it affords green feed several weeks after our important native species have gone dormant because of cold weather and have lost much of their nutritive value.

Several grazing tests have been made of the two lovegrasses here on the ranch. The first two were made for a short period in the middle of winter, when most of the tops had dried. Only a little green remained in the lower parts of the plants. Boer lovegrass was used to a much greater degree than Lehmann lovegrass in both these tests.

Some of you will remember that we had a small group of 10 cows on this 16-acre pasture last year. These cattle had been in the pasture for 25 days on Ranch Day last year and were removed from the pasture that day. They were weighed into the pasture and weighed out, and these weight records showed that they gained an average of a little over two pounds per day while in the pasture. The cows made very good use of the grass. Almost every plant was grazed some and most were well used. Stubble heights varied from 3 to 10 inches.

This year we are using 26 heifers, averaging about 19 months of age on the lovegrass pastures. The pasture was enlarged by fencing in about 17 acres of mixed planting made in 1941, making a total area of about 33 acres.

The heifers were first admitted to the 17 acres of the 1941 planting, and when this was pretty well used, they were turned into the 1942 planting, where they are at present. They have been on the two areas a total of 24 days at present.

Our computation of costs of this kind of seeding runs from about a dollar and a quarter per acre for single disc seeding to about two dollars per acre for double disc seeding. Grazing values observed would seem to well justify these costs.

It is our feeling that in addition to the direct advantages gained in improved ground cover and forage production, certain indirect values are obtained. These occur through the relief of pastures carrying too heavy a grazing load that can be made by switching stock from such areas to the reseeded pasture. There is hardly a ranch that hasn't at least some pasture or rangeland that needs rest or a lightened grazing load in order to recuperate lost vigor or density of the better forage grasses, or rest to keep from undergoing deterioration. This is just where re-seeded areas are able to pay off double, first by grazing stock that they could not support before reseeding and again by giving relief to other overloaded range areas.